



## PRINCIPLES OF THE NOBLE METALS EXTRACTING OUT OF COAL DEPOSIT CAP ROCKS

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**Key words:** hydrometalurgia, electrodeposition methods, ferrocyanides substitutes

**Abstract:** Experimental results on gold extraction by the hydrometallurgy and metal electrodeposition methods from the cap rocks of the Pavlovskoe deposit (south of the Russian Far East) are presented in the article. The suggested principles of the mineral raw material processing will assist in fast developing of gold potential of the coal deposits in Russia as well as in other countries of the world

### 1. Introduction

Experimental results on gold extraction by the hydrometallurgy and metal electrodeposition methods from the cap rocks of the Pavlovskoe deposit (south of the Russian Far East) are presented in the article. The suggested principles of the mineral raw material processing will assist in fast developing of gold potential of the coal deposits in Russia as well as in other countries of the world.

### 2. Extracting out of coal deposit

Several large coal-fields (Pavlovsk, Luzanonovsk, Luchegorsk, etc.) in which coal-bearing cap rocks contains anomalously high contents not only of the noble metals (gold, platinum, palladium) but also other ore-genic elements (for example molybdenum, nickel, cobalt) are situated at the Far East South. At present the main mass of these cap rocks are accumulated as tailings that occupies considerable areas. Thus, the annual volume of stripping at Pavlovsk coal-fields equals 18 millions cubic meters and one can imagine how many hundreds millions cubic meters of stripping rocks are accumulated within many years of exploitation of coal-fields. The main purpose of our investigation was creation of the principles of technological machinery providing the most complete separation of the noble metals (NM) from these carbonaceous technogenic formation as well as generalization of knowledge on the scientific, technical, and economic aspects of these of this problem on the whole and expedience of usage of the technological ways worked out in large scale. The main object of our investigation was Pavlovsk coal-field. Mineralogical, geochemical, and ehnological study of the cap rocks let to conclude about real possibility of extraction of noticeable amount of NM from these rock.

In experimental version this problem was solved using the gravitation methods of the cap rock separation at the beginning of the process and following leaching of useful components from the concentrates obtained with potassium ferrocyanide solution in the presence of oxidizer. Preference of potassium ferrocyanide as compared with usually used sodium cyanide solution first of all consists in absence of toxic properties of our reagent and, therefore decrease of ecological loading on the environment. Our study showed that leaching of gold-containing concentrate with potassium

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ferrocyanide solution in the presence of oxidizer in alkaline medium gave satisfactory results of gold extraction. It is the most expedient to recover the noble metals from the leaching solution by electrodeposition onto fibrous carbon cathodes. Moreover, a certain portion of potassium ferrocyanide may be regenerated that lowers its specific expenditure and makes the process cheaper.

### **3. Conclusion**

Possibility of ferrocyanides usage as substitutes of cyanide solutions for extraction of the noble metals contained in various kinds of mineral raw material, including technogenic one, opens new perspectives for working out the technology which lets not only to obtain NM but at the same time to solve the actual ecologic problem-utilizing of the cap rock. Usage of ferrocyanide solution for dissolving of NM as compared with cyanideones has several advantages including lowering of influence of impurity ions on extraction of NM, creation of safe labor conditions and lowering of ecological loading on the environment.

Thus, our work based on usage of non-cyanide leaching solution and electrodeposition of NM onto fibrous carbon cathodes let to create at the first time and to test under experimental condition the complex technology (with utilizing of separation tailings) providing high degree of recovery of useful components. The ways to the problem of the cap rock processing will promote to the nearest mastering of the gold potential of coal-field not only of the Russian Far East.